



4-10 STANDARD SLAB BRIDGE - GENERAL INSTRUCTIONS

Makeup of Plans

1. General Plan

See Section 3, *Bridge Design Details* (BDD) manual. The “General Notes” are shown on the Slab Reinforcement Details sheet (xs1-220). These notes should be modified to conform to current standards.

2. Deck Contour

See Section 4, BDD manual.

3. Foundation Plan

See Section 5, BDD manual.

4. Abutments and Bent Details

See Section 6 & 7, BDD manual. Wingwalls details per Standard Plan B0-1 will generally be adequate.

Dropped bent caps (typically required in bridges with spans less than or equal to 24 feet) should be fully detailed showing the plan, elevation and section. For aesthetic reasons, the dropped portion of a bent cap should be terminated at least 1'-0" from edge of deck. For flush caps, the width of stirrups must be indicated.

5. Deck Details

Plan views of both top and bottom slab reinforcement are required. Indicate length, total number and placement data for each class of main reinforcing bars. Also show the typical section, the camber diagram, main reinforcing bars and a diagram for payment of concrete. A longitudinal deck sectional view is unnecessary since it is shown on “xs1-220”.



6. Slab Reinforcement Details

Insert “xs1-220”, with appropriate modifications, as a part of the Plans for every slab bridge. See Basis of Design – General Design Considerations.

7. Slab Hinge Details

See Basis of Design – Hinges. Insert “xs1-210”, with appropriate modifications, as a part of the Plans when a hinge is required.

8. Railing Details

Refer to book of Standard Plans or insert appropriate sheets.

9. Reference to book of Standard Plans

The following sheets are required:

- A62-C “Limits of Payment for Excavation and Backfill-Bridge”;
- B0-1 and B0-3 “Bridge Details”.

Other sheets should be referenced as required.

10. Log of Test Borings

Insert “Log of Test Borings” sheet(s).



Basis of Design

The design considerations and the design assumptions made in developing the Slab Design Charts are summarized in the following sections.

1. Design Method

Load Factor Design based on Caltrans Bridge Design Specifications.

2. General Design Considerations

The design engineer shall ensure that the entire structural system meets *Caltrans Seismic Design Criteria* (SDC) requirements. Additional issues, including those described below, should be considered during analyses and design:

- (i) The standard piles shown on the accompanying charts, (details are shown in the Standard Plans/Charts) may not have sufficient longitudinal and transverse reinforcement to provide adequate strength and ductility for all load cases.
- (ii) The top of the pile extensions/columns may either be fixed or pinned to the slab or bent cap. When the top of the pile extension/column is fixed, investigate the need for additional slab and bent reinforcement in accordance with SDC. Also, ensure that such a connection is properly engineered and detailed to provide adequate ductility and capacity.
- (iii) For all load cases, when a pile/pile-column is designed to perform as a fixed connection at the top, ensure that the pile reinforcement can be properly anchored. In some cases, a bent cap may be required to provide the necessary development length.
- (iv) The design engineer should calculate the camber (identified as “ultimate deflection” in the charts) for slab bridges having four or more spans. The camber values shown in the accompanying charts for such bridges shall not be used.

3. Distribution of Wheel Loads

The distribution of wheel loads conforms to Caltrans BDS Article 3.24.3.2 as appropriate.

4. Slab Thickness

The thickness of the slab is designed in accordance with Caltrans BDS Article 8.9.2.

5. Environmental Factor Z

An environmental factor of 170 kip/in. has been used in the charts. If the exposure condition is different (see BDS Articles 8.16.8.4 and 8.22), then the rebar distribution has to be verified.

6. Span Length

Actual span lengths are shown for all except “D” spans. For a span configuration of 18'-24'-18', the chart values for $L=24'$ should be used for all 3 spans. “D” span values in the chart are based on $(0.75)L$ or 18' in this case. For intermediate span lengths, interpolate between the values given in these charts.

7. Skew

The charts allow for skews of up to 50° for superstructure design. A special design is required when the skew angle exceeds 50° . Piles may have to be added at the abutments to support the obtuse corners of the slab. See “Support Design Data” and “Typical Support Calculations” sheets.

In general, avoid skews over 30° (due to seismic concerns).

8. End Diaphragm Abutment

Abutment design is based on the recommendations in *Memo to Designers* (MTD) 5-2 with appropriate modifications per SDC. Effective longitudinal force is obtained by dividing the total force by effective abutment width.

9. Hinges

- (i) In new slab bridges, if hinges are required, then they shall be properly engineered so that they are adequate for all load cases. In general, hinges should be located at the bents as shown in “xs1-210”. The design engineer shall verify the adequacy of the details shown, and make suitable changes prior to inserting this sheet as a part of structure plans. Provide joint seal data, “A” bar size, and elastomeric bearing pad size.
- (ii) In-span hinges should be avoided in new slab bridges. Such hinges have been used in the past to provide an unbroken soffit line for aesthetics. However, since slab bridges are typically not used as over-crossings/under-crossings, the relative merits of aesthetics and structural performance should be carefully considered

- (iii) When widening slab bridges, design engineers should, in general, match new hinge locations with those on the existing bridge. Furthermore, if an existing slab bridge has a steel hinge, then the design engineer should consider incorporating a concrete hinge in the widening. Insert “xs1-210”, and modify hinge details as required. Verify the adequacy of hinge details, including seat length, for all load cases.
- (iv) Note that when an existing slab-bridge with in-span hinges is being widened, a longitudinal joint may be required if the design engineer chooses not to match existing hinge locations. Longitudinal bridge joints are strongly discouraged since they lead to performance and maintenance problems. Hence, this option may be considered only as a last resort.

10. Piles

In addition to the issues stated in **General Design Considerations** above, the following assumptions have been made for standard pile design used in the charts.

- (i) Maximum unsupported length of pile-extension/column, including the effects from scour, is 25 feet.
- (ii) Forces due to stream current and debris effects are not considered.
- (iii) The pile is founded in compact sandy soil (or better) and/or stiff clay (or better).
- (iv) Bridge response under the combined effects of seismic and scour (BDS 4.4.5.2) has not been considered.
- (v) The live load demand on a pile-extension/column has been computed by distributing the live load reaction (from the slab) equally to all the columns in a bent. This assumption may not be valid for all cases. The design engineer should verify the validity of this assumption through analyses.

If the above assumptions do not apply, then a site-specific analysis and design will be required.

Insert “xs1-230” where appropriate. “xs1-230” shows the steel shell terminating below the ground line. If this detail is adequate from design considerations, then the Specifications may permit the contractor to extend the shell in which case the shell should terminate 2 to 4 inches below the soffit. The design engineer should convey this information to the specifications engineer through a “Memo-to-specifications engineer”.

If a full height steel shell is required from design considerations, then the shell shall terminate 2 to 4 inches below the soffit line. Such a termination ensures that the ductility of the joint is not negatively impacted, and that a significant additional moment is not transferred to the slab. “xs1-230” should be modified accordingly.



11. Drainage

Scuppers or deck drains must be specially detailed when necessary.

12. Utilities

Refer to MTD 18-2 for details showing minor/small utilities in slab bridges. Contact Structure Maintenance and Investigations if a slab bridge needs to carry bigger utilities.

13. Quantities

The charts show approximate slab quantities for one lineal foot of slab width. The reinforcement for caps and end diaphragms as well as any concrete extending outside the slab limits is not included in these charts.